

Abstract

The photosensitive volume of a pixel is extended beyond the photodiode region, which allows the pixel sensitivity to be relatively independent of the photodiode region. In an example embodiment, the photosensitive volume can be maximized by using a CMOS process to remove heavily doped material (e.g., as from in a P well) from the photodiode and to form a pn junction on lightly doped material (e.g., p-type epitaxial layer). The photosensitive volume is thus defined by the larger area of the lightly doped material rather than being merely restricted to the photodiode region. Based on the requirements of signal-to-noise ratios (SNR) and desired dynamic range (DR), a minimized size photodiode (with optimized area and perimeter) can be designed to maximize photo conversion gain, which maximizes sensitivity.